

# GNSS DATA ACQUISITION AND PROCESSING-APPLICATION FOR SUSTAINABLE DEVELOPMENT OF THE TRANSPORTATION INFRASTRUCTURE

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Applications of Global Navigation Satellite Systems

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How data becomes solutions

## Introduction

- **Mobile Laser Scanning System**

- Applications

- **SiRailScan**

Analysing point clouds, modelling alignment

- **Atrack-R and Verm.esn**

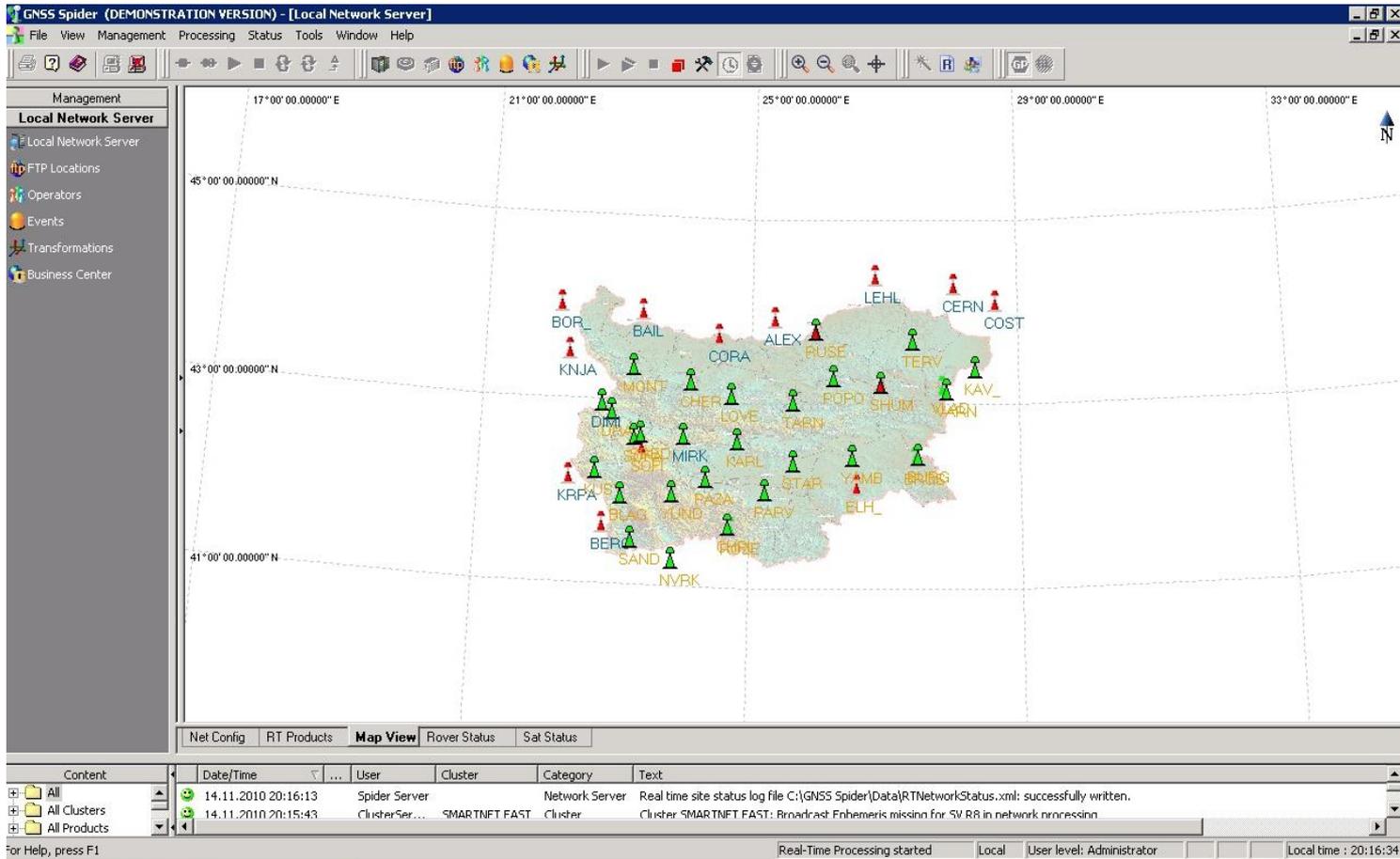
Analyze polylines and recover track elements

- **Managing scan data and additional information integrated into SiRail Manager**

- **SirailView and SirRailLayers**



# Network configuration



The screenshot displays the GNSS Spider (DEMONSTRATION VERSION) - [Local Network Server] interface. The main window shows a map with numerous receiver stations marked by colored triangles and labeled with station names such as BOR\_, BAIL, ALEX, ROSE, LEHL, CERN, COST, KNJA, COPA, TERY, KAV\_, MONT, CHEF, LOVE, TARN, SHUM, MIAN, DIMI, SPT, MIRK, RAPL, STAR, YAMB, BRIBS, KRPA, BLAS, LIND, PAZA, PARY, ELH, BERG, SAND, NYRK, and ROPE. The map includes a coordinate grid and a north arrow.

The bottom status bar shows the following information:

- Net Config
- RT Products
- Map View**
- Rover Status
- Sat Status

The log window at the bottom contains the following entries:

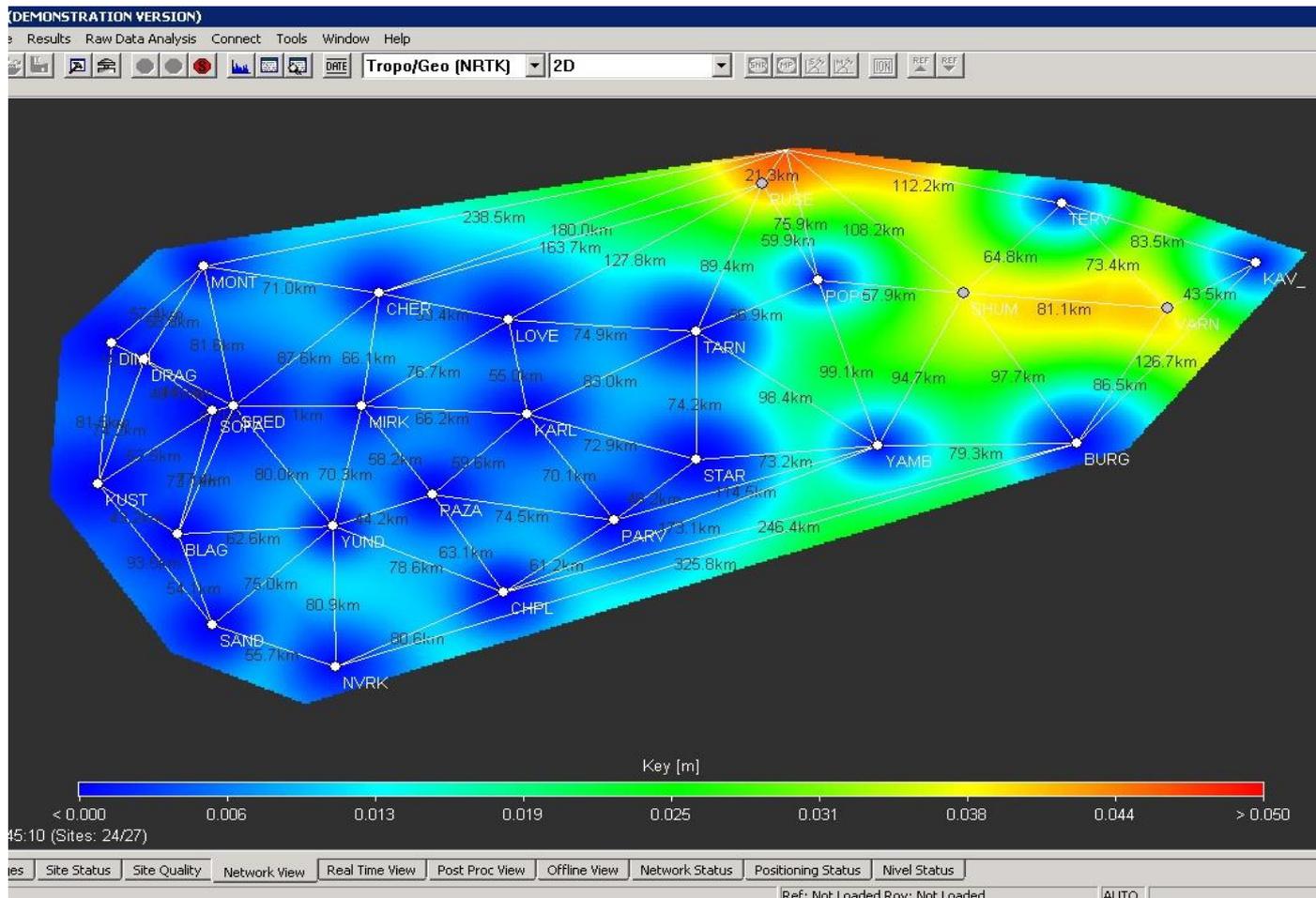
Content	Date/Time	User	Cluster	Category	Text
All	14.11.2010 20:16:13	Spider Server	Network Server	Network Server	Real time site status log file C:\GNSS Spider\Data\RTNetworkStatus.xml: successfully written.
All Clusters	14.11.2010 20:15:43	Spider Ser...	SMARTNET FAST	Cluster	Cluster SMARTNET FAST: Broadcast Enhemeris missing for SV RR in network processing

Additional status information at the bottom of the window includes: "Real-Time Processing started", "Local", "User level: Administrator", and "Local time : 20:16:34".



## Railway scanning

# Network accuracy



Spider Software by Leica



Railway scanning

## MLS technology and its applications for highways monitoring

- Scanning system flexible mounted on various vehicles constructions



Railway scanning

Analyzing and processing point clouds with SiRailScan





Railway scanning

# MLS technology and its applications for railway monitoring and optimization





## Railway scanning

- High-end 3D Railway monitoring GNSS based system



RIEGL VMX-450 Mobile Scanning System  
([www.riegl.com](http://www.riegl.com))

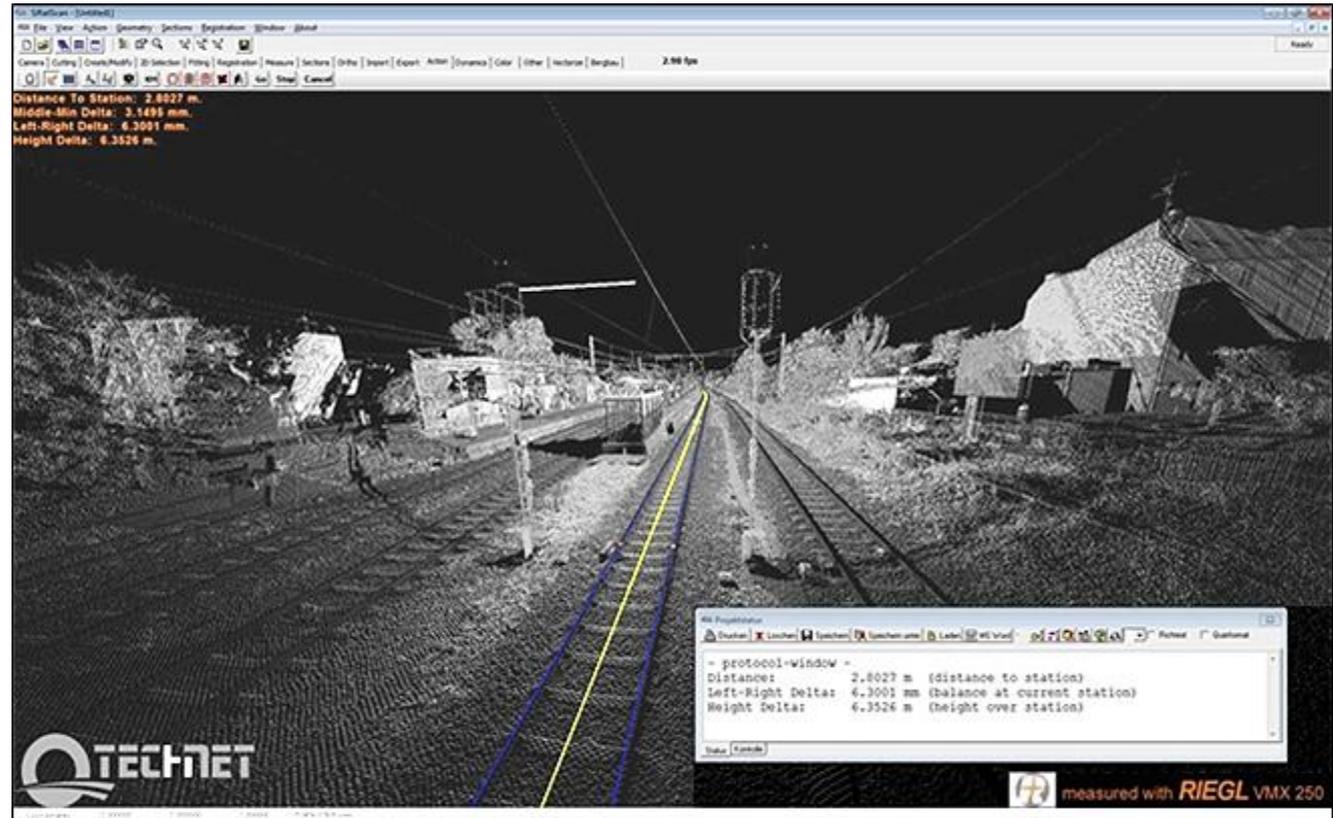
[www.nipistroytek.ru](http://www.nipistroytek.ru)



## Railway scanning

### Analyzing and processing point clouds with SiRailScan

- Transition from raw measurement data to 3D point clouds into desired coordinate system especially in chainage based railway reference system
- Detection of rails and infrastructure objects
- Calculation of axis and axis related measurements
- Collision detection with any wagon shape
- Ortho views and sections
- Several import and export interfaces

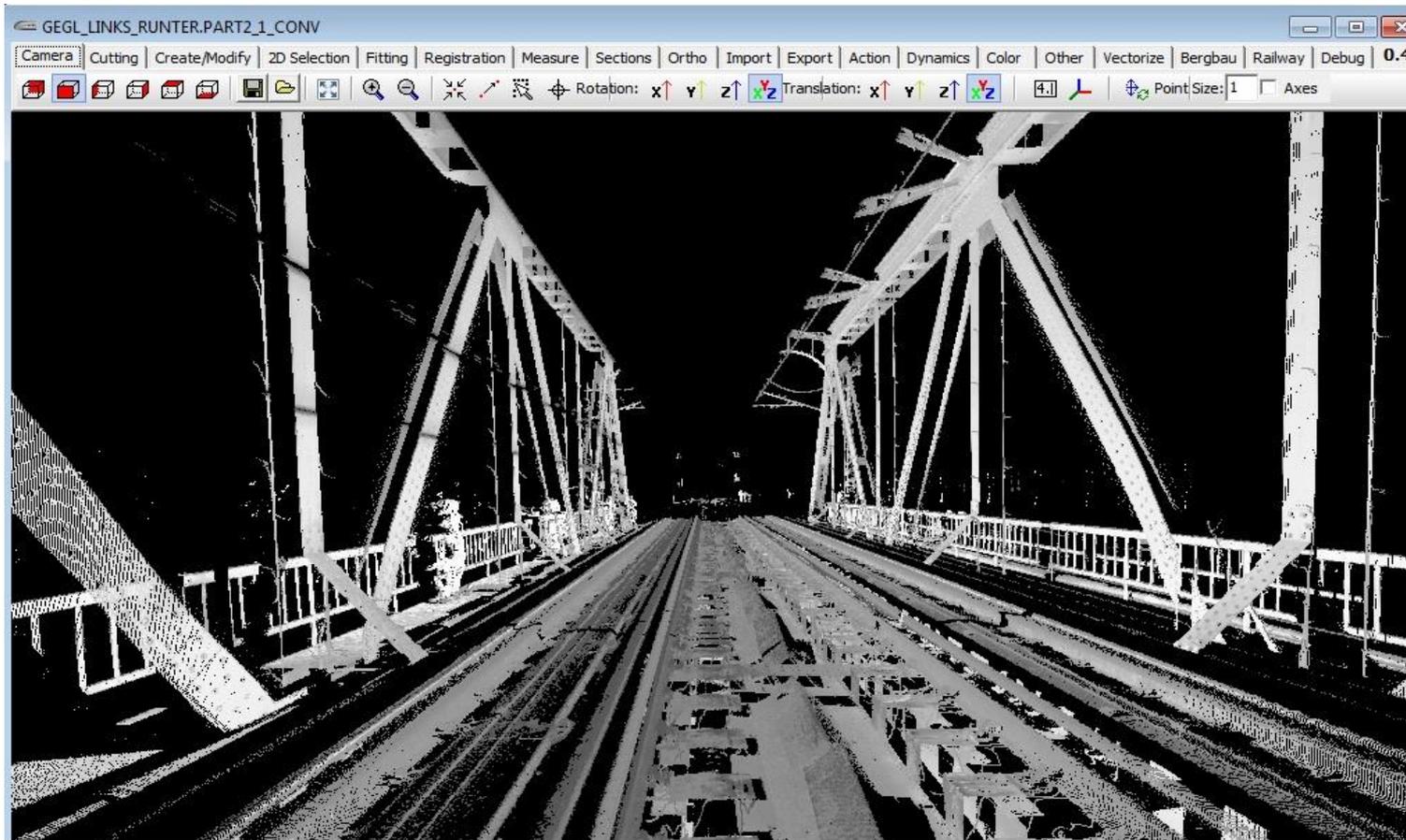


Rails and axis calculation. Perpendicular measurement of distance and height above axis to any point



## Railway scanning

Analyzing and processing point clouds with SiRailScan for railway bridges monitoring

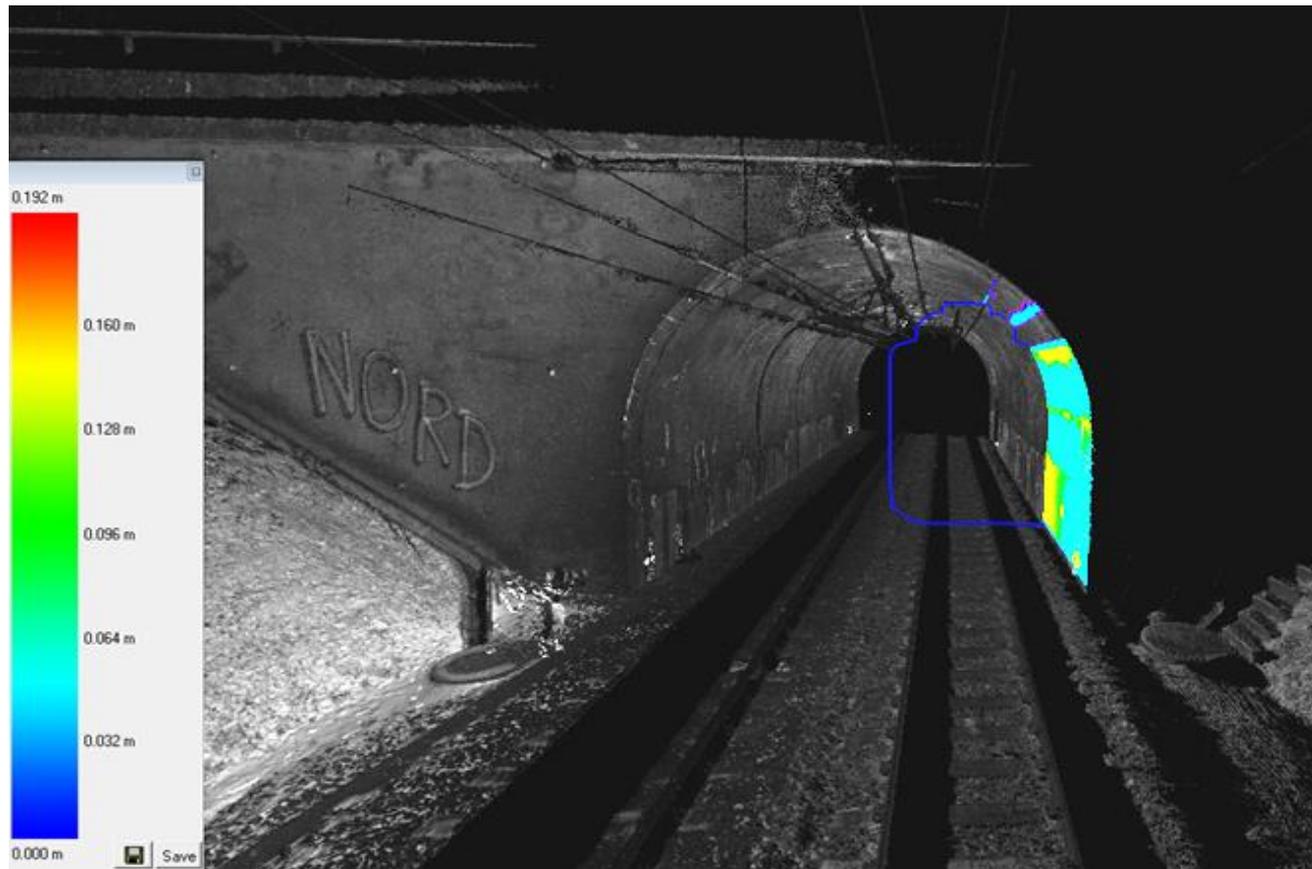




## Railway scanning

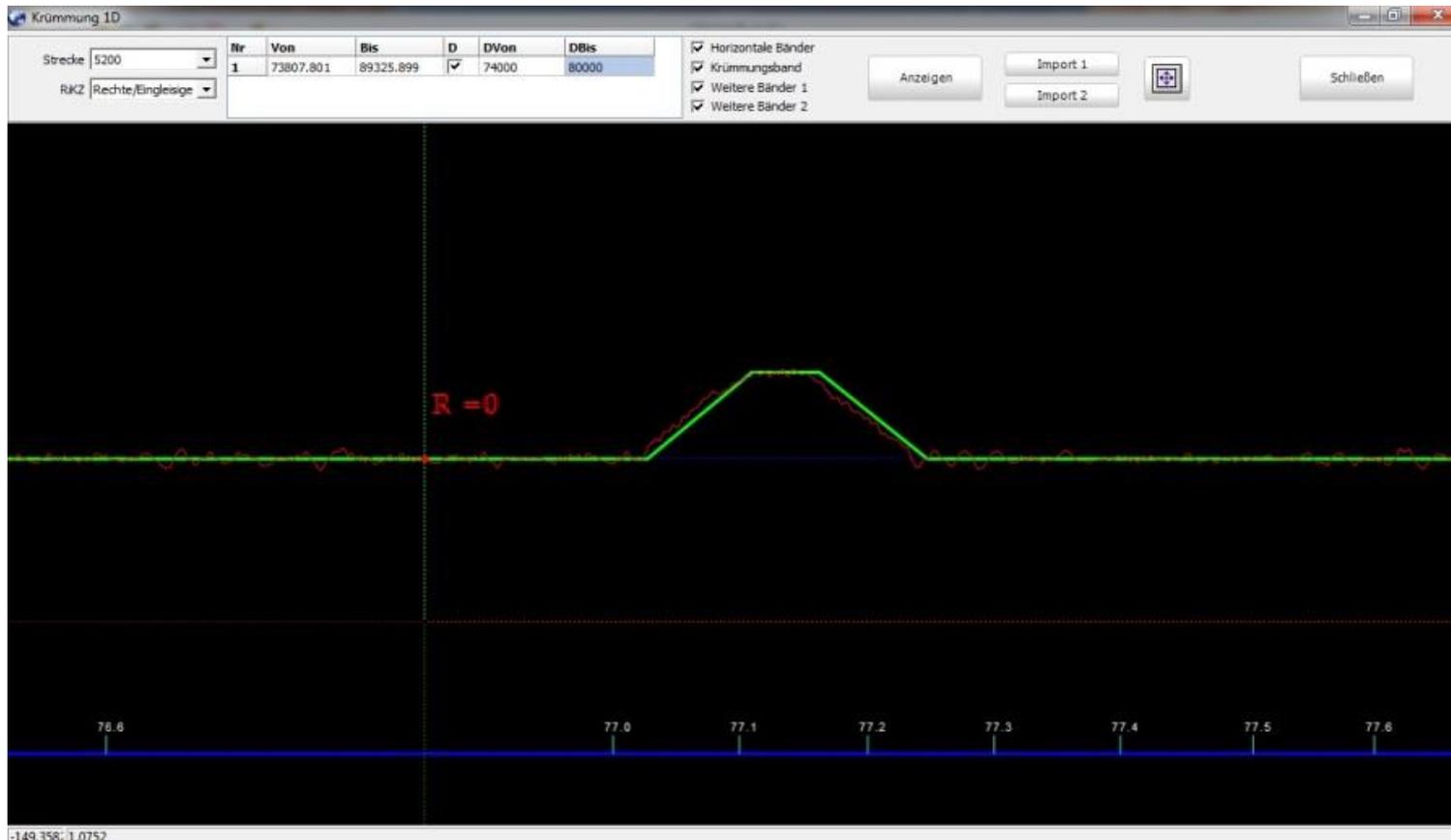
### Analyzing and processing point clouds with tunnel specialized application

- Axis based analysis in axis refered point clouds



## Curvature elements based on the recorded INS data

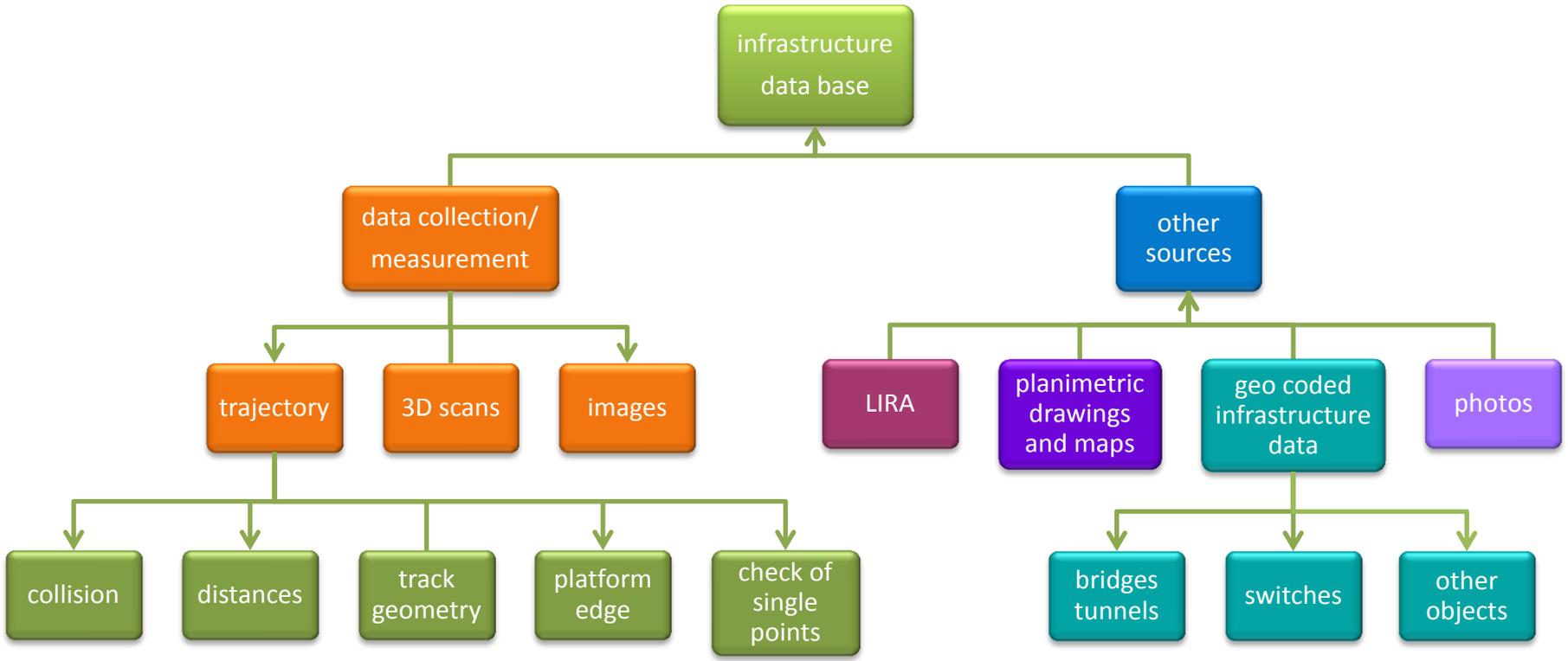
- Axis based analysis





**Railway scanning**

# Spatial database. Environmental Resource Information Network

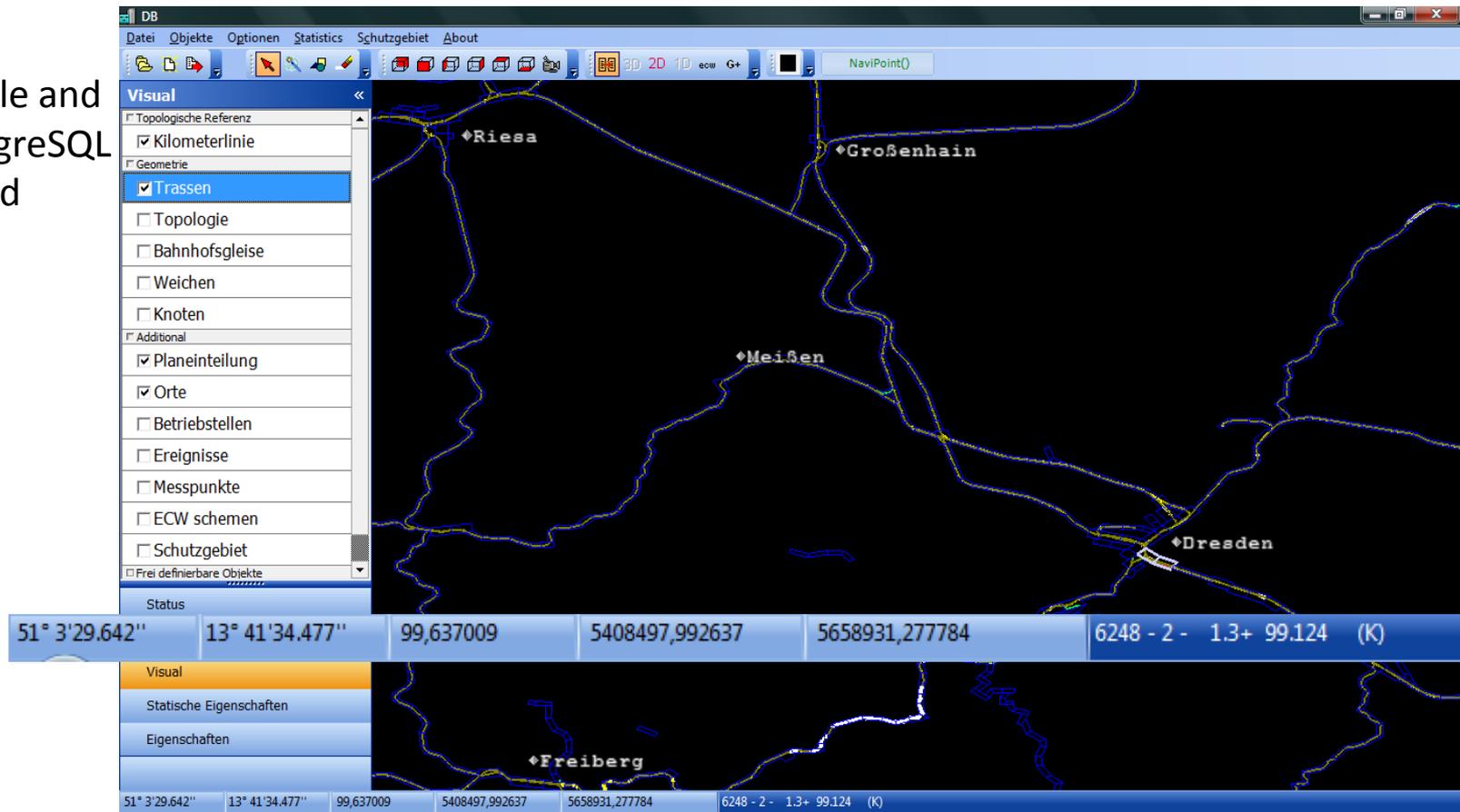




## Railway scanning

# Integrity of the railway navigation database Ambiguity free system determination

- Oracle and PostgreSQL based



The screenshot shows a software window titled 'DB' with a menu bar (Datei, Objekte, Optionen, Statistics, Schutzgebiet, About) and a toolbar. The main area is a map of the Dresden region, showing railway tracks and stations like Riesa, Großenhain, Meißen, Dresden, and Freiberg. A 'Visual' panel on the left lists various data layers with checkboxes:

- Topologische Referenz
  - Kilometerlinie
- Geometrie
  - Trassen
  - Topologie
  - Bahnhofsgleise
  - Weichen
  - Knoten
- Additional
  - Planeinteilung
  - Orte
  - Betriebstellen
  - Ereignisse
  - Messpunkte
  - ECW schemen
  - Schutzgebiet
- Frei definierbare Objekte

At the bottom, there is a status bar with the following data:

51° 3'29.642"	13° 41'34.477"	99,637009	5408497,992637	5658931,277784	6248 - 2 - 1.3+ 99.124 (K)
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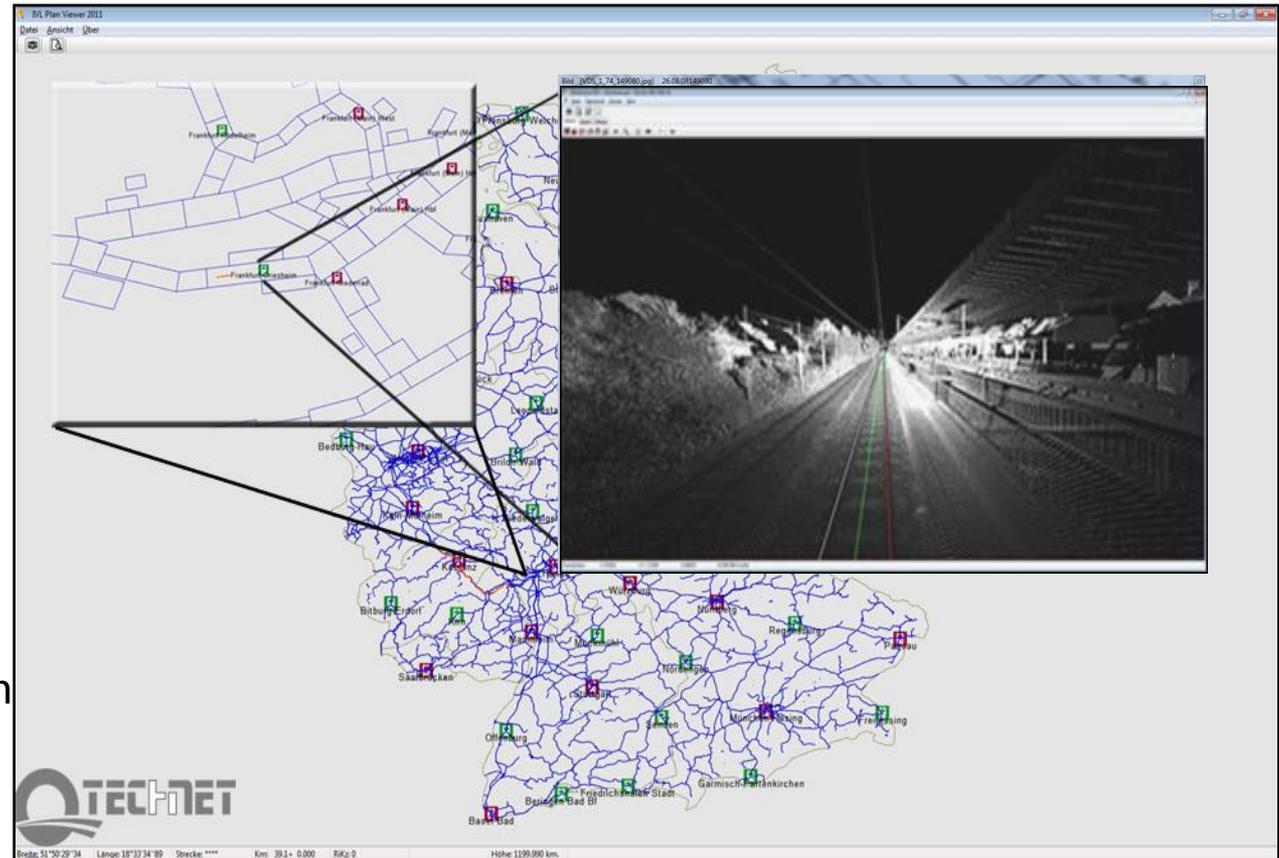
Below the status bar, there are buttons for 'Visual', 'Statische Eigenschaften', and 'Eigenschaften'. At the very bottom, the same status bar data is repeated.



## Railway scanning

# SiRailManager

- Managing of the kinematic point clouds
- Combining the point clouds with web based map services and planimetric drawings
- Client-Server or web based access to all point cloud data (with SiRailViewer)

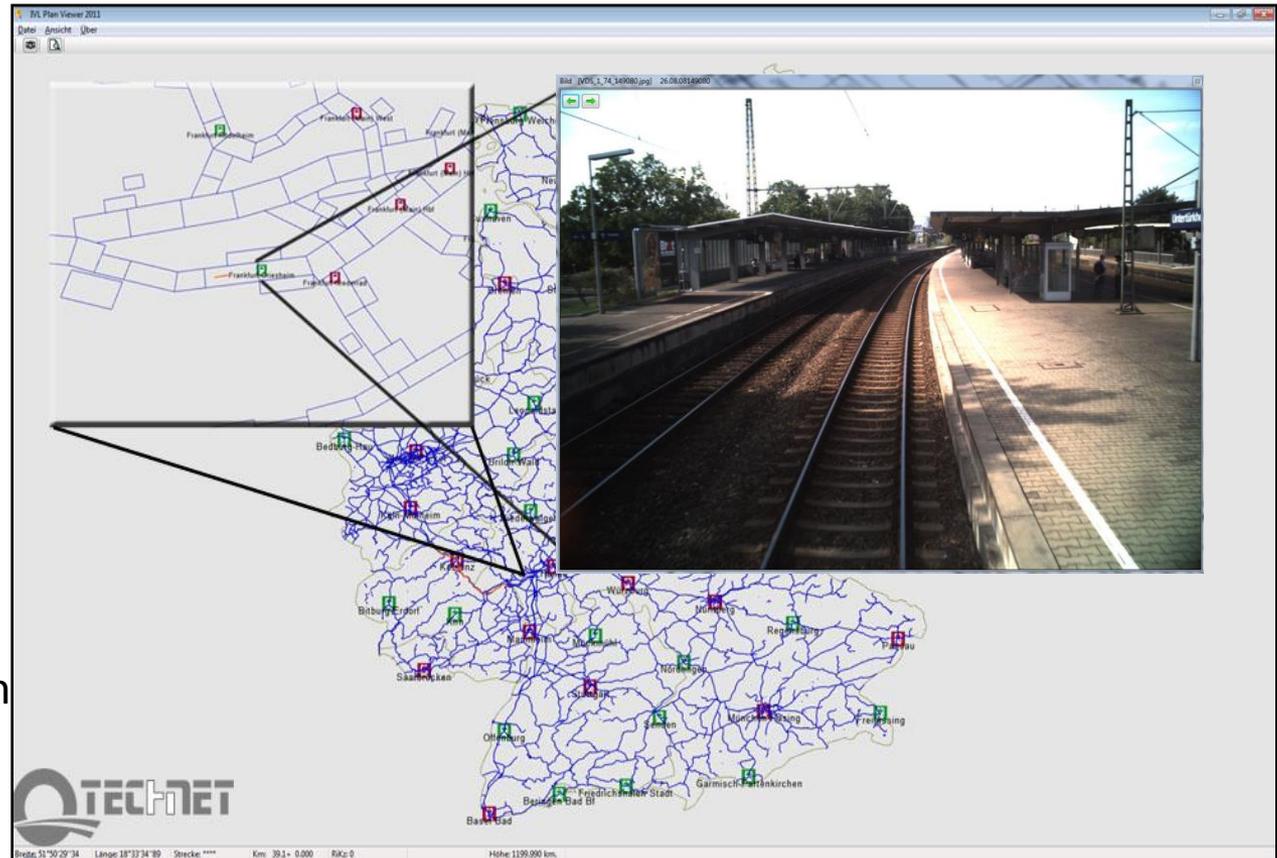




## Railway scanning

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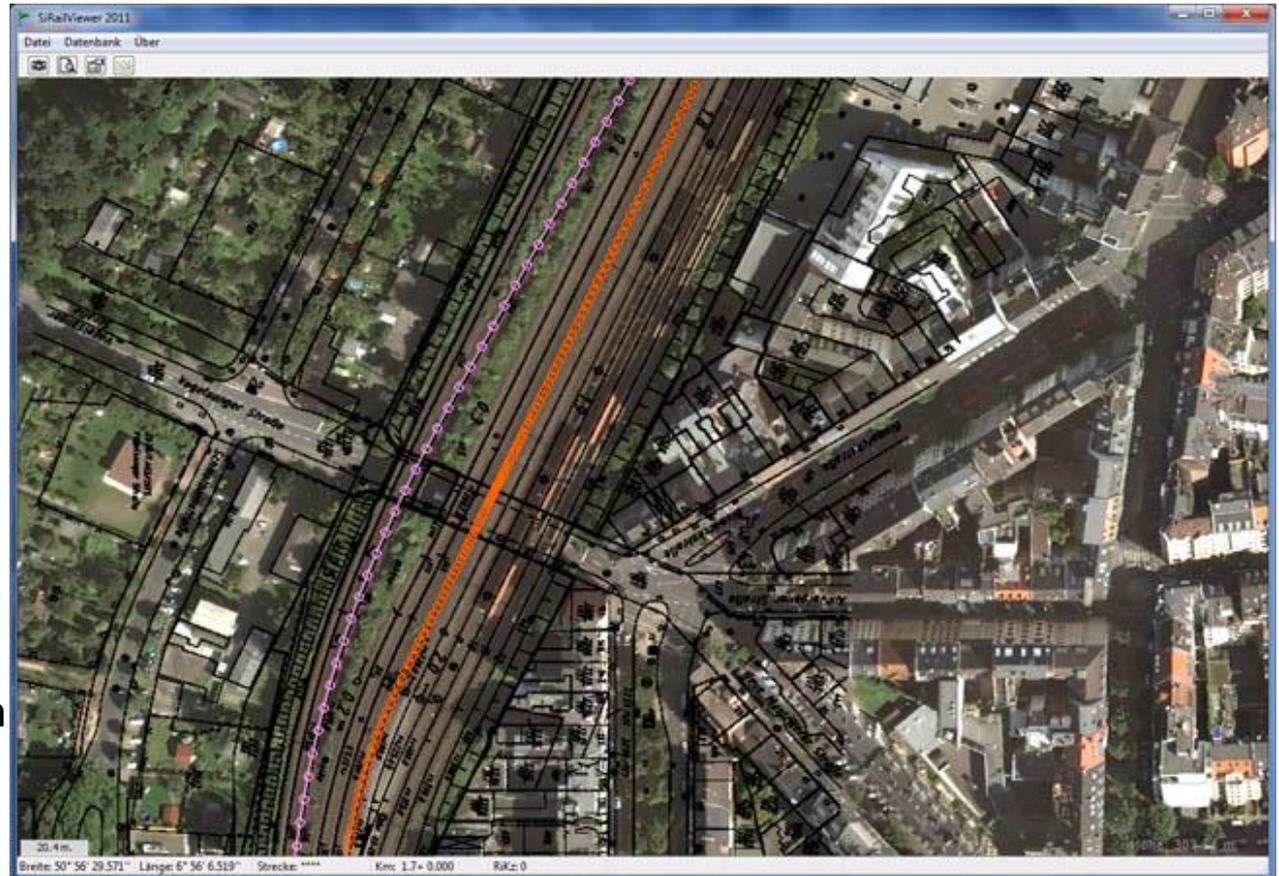
Visualize the timestamped and georeferenced photos from the measurement system



## Railway scanning

# SiRailManager

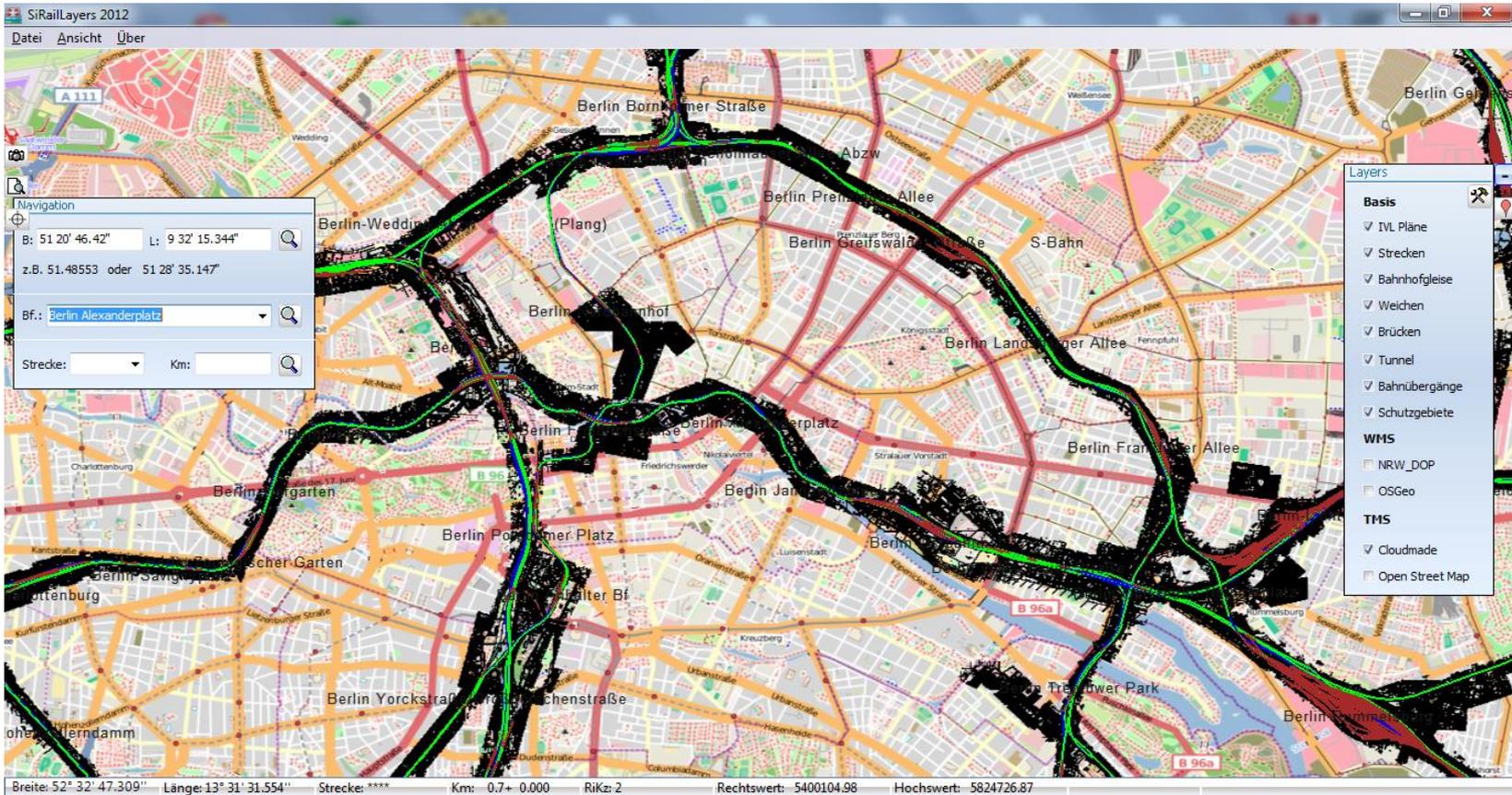
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## Railway scanning

# SiRailLayers



SiRailLayers 2012

Navigation

B: 51 20' 46,42" L: 9 32' 15,344"  
z.B. 51,48553 oder 51 28' 35,147"

Bf.: Berlin Alexanderplatz

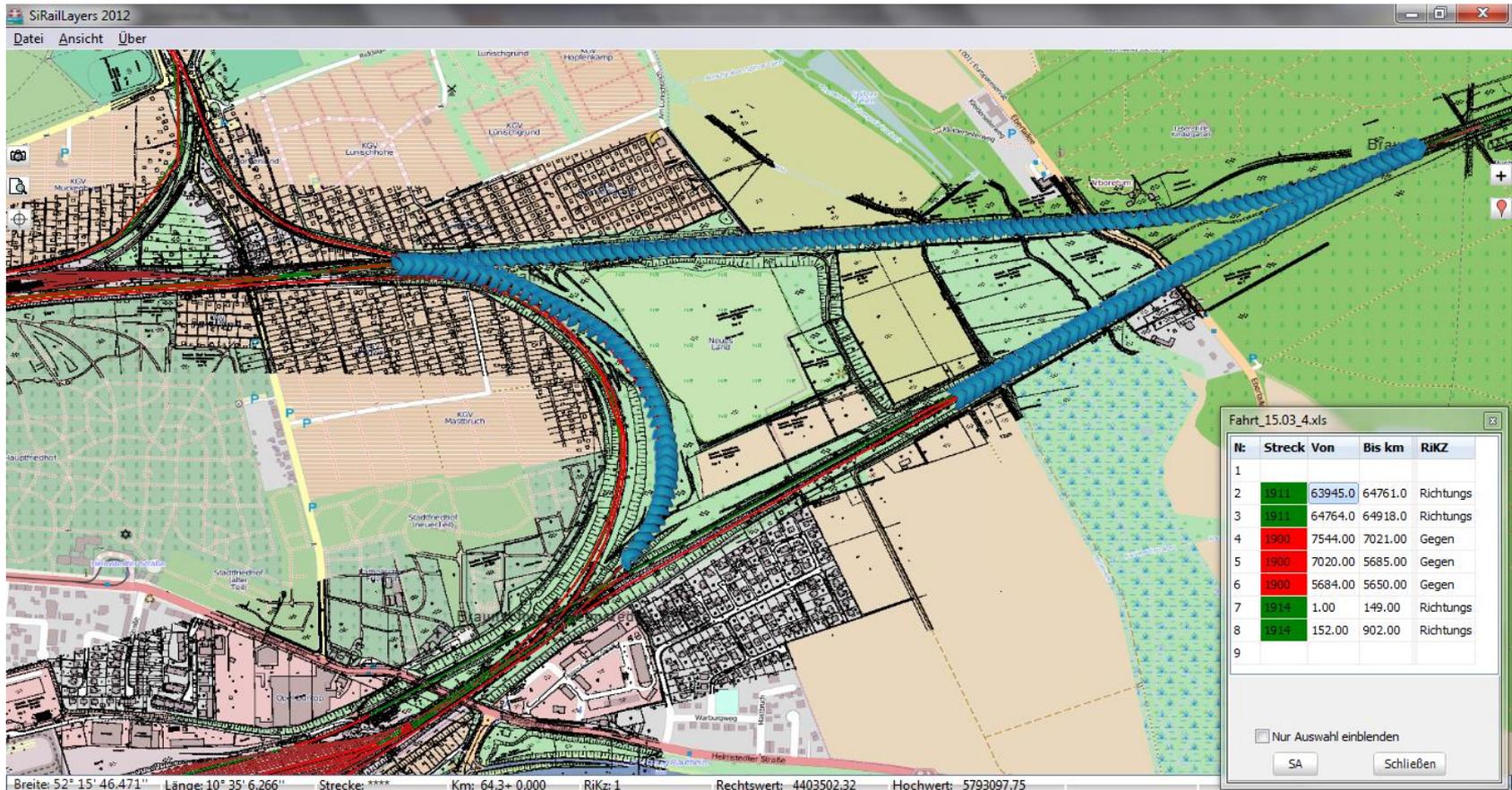
Strecke: Km:

Layers

- Basis**
  - IVL Pläne
  - Strecken
  - Bahnhofgleise
  - Weichen
  - Brücken
  - Tunnel
  - Bahnübergänge
  - Schutzgebiete
- WMS**
  - NRW\_DOP
  - OSGeo
- TMS**
  - Cloudmade
  - Open Street Map

Breite: 52° 32' 47,309" Länge: 13° 31' 31,554" Strecke: \*\*\*\* Km: 0,7+ 0,000 RiKz: 2 Rechtswert: 5400104,98 Hochwert: 5824726,87

# SiRailLayers - Measuring route planning



## Conclusion

- Hardware: fully-calibrated and integrated measuring system – quick setup – mm accuracy
- Complete **automated** processes in real time and post processing
- Mounting configuration of Laser Scanners allows acquisition of traffic signs perpendicular to trajectory
- Reliable survey of the environment – analysing in 3D – clearance analysis, collision tests, distances, extract geometrical elements
- 3D spatial data based on several data sources/ single **databases**
- **Harmonized** information system for GNSS based navigation and maintenance

Thank you for your  
attention!

How data becomes solutions